T24-AR

Active Repeater

User Manual
mantracourt.com

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Wireless Telemetry Range 2.4Ghz

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Introduction / Overview

The T24-AR is an active repeater which will allow the T24 range of modules to span around obstacles or increase range or coverage.
The connectivity module provides a battery holder for a pair of alkaline 'D' cells and has regulator circuitry for an external power supply. The batteries can also be used to provide power in case of external supply failure. The case is environmentally sealed to IP65.

The repeater will allow messages to be repeated once which can effectively double the radio range. Adding more repeaters will not increase range but can increase coverage.

Increase Range

With No Repeater

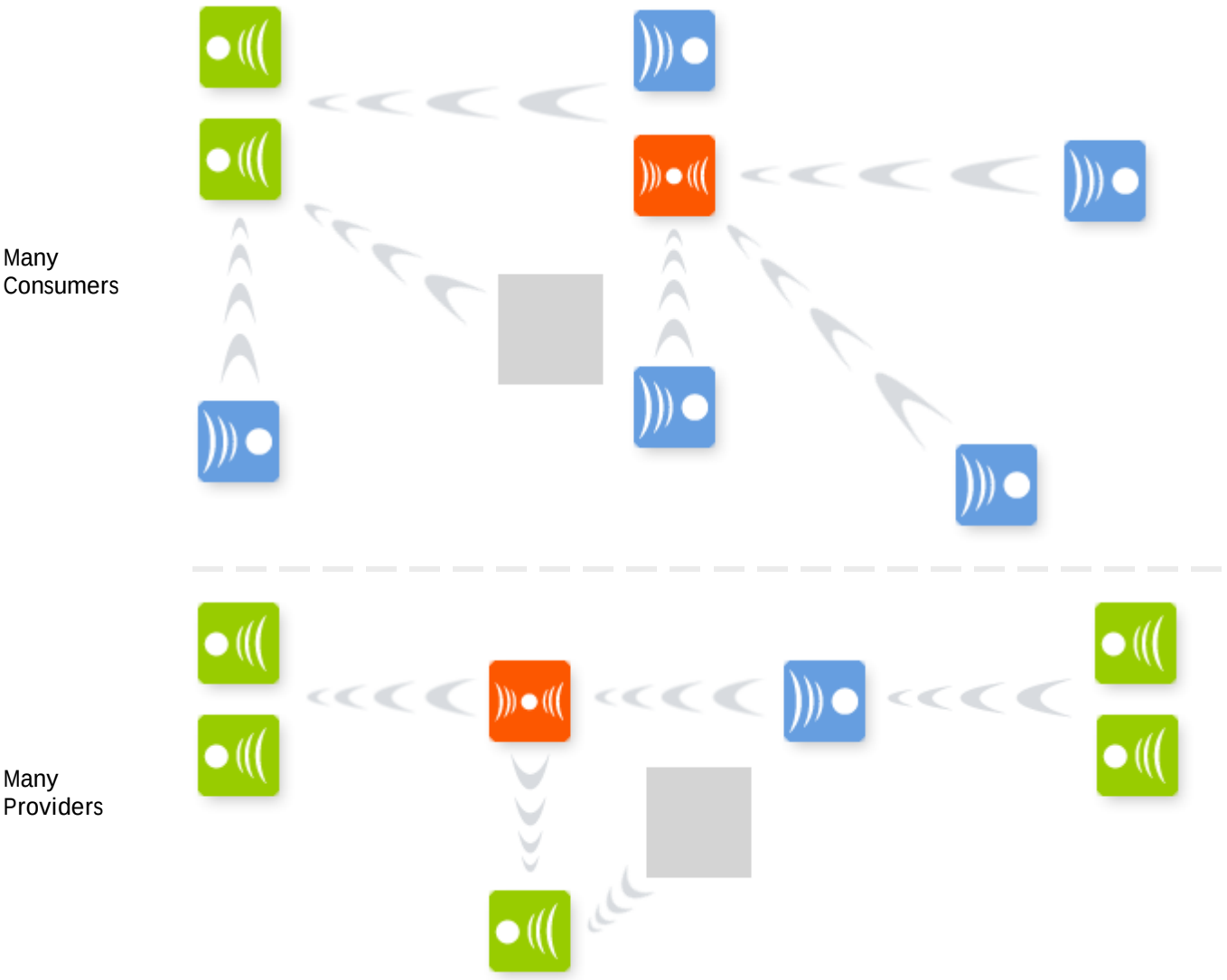
With Repeater

Span Obstacles

With No Repeater

With Repeater

Combined Solutions



Power Options

The T24-AR can operate permanently powered or can operate from on-board batteries.

Permanently Powered

This is the simplest way to operate the repeater. With a permanent supply you do not need to worry about the repeater sleeping or waking. You can optionally choose whether the repeater always wakes sleeping modules and then you could utilise the powering up of the repeater to wakeup those modules outside the normal radio range.

Battery Powered

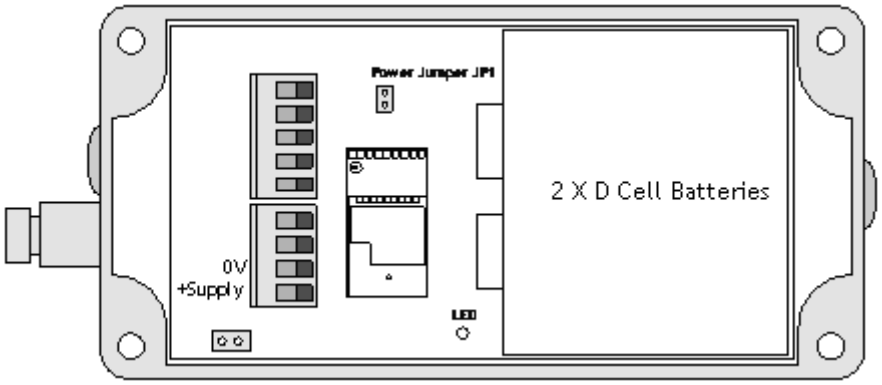
In low power battery mode the repeater wakes from sleep when other modules are woken and will remain awake until it stops receiving Stay Awake messages. This will work transparently with most T24 instrumentation. Please note that a T24-HS handheld would require radio firmware version 2.01 or above to be able to wake a repeater when powered on.
You just need to decide on the Sleep Delay for a battery powered repeater. This causes the repeater to enter sleep mode if it does not receive stay awake messages within the Sleep Delay time.
Stay awake messages are transmitted by handhelds, analog output modules and PC software etc so that when those items are turned off or disabled all other T24 modules will sleep when their Sleep Delay time elapses.

Connecting Power

Power can be supplied by fitting 2 X ‘D’ cell alkaline 1.5 Volt batteries or the module can be supplied from an external 5V to 18V DC source.

In both cases you need to fit the JP1 power jumper to supply power to the acquisition module.
When powered from the external DC source the LED will illuminate.

If internal batteries are fitted when external power is applied the batteries will be utilized if external power is lost.



Getting Started

Use the T24 Toolkit to ensure that the repeater radio channel matches the rest of the T24 modules. You will then need to decide whether the repeater is battery powered or permanently externally powered and whether it should always wake other sleeping modules when it is powered up and awake.

Considerations

- Each repeater can effectively double the amount of traffic transmitted. Be careful not to introduce too many repeaters that are within range of each other as there may be un-necessary duplication of radio traffic. Carefully plan the layout of radio modules to minimise this.
  Using the Data Provider monitor in the T24 Toolkit can show the amount of traffic. The T24 Toolkit on a laptop or netbook is ideal for checking installations as it is mobile so traffic can be monitored at different points in the installation.

- A repeater will not repeat a packet that has already been repeated. Hence there is only one extra 'hop' introduced and a maximum range increase to 2X.

- When waking remote modules separated by a repeater and that repeater is asleep it may take twice as long to wake a module as when no repeater is involved.

- If the repeater is to be battery powered use the same Sleep Delay as is suitable for the acquisition modules in the system.

- You cannot pair to a module through a repeater. Using the T24 Toolkit it **may** be possible to configure module through a repeater by connecting **without** pairing. The results will vary depending on the number of repeaters and amount of radio traffic. In some cases it may be necessary to power down repeaters when configuring modules.

- Most data consumer modules and software issue a broadcast wake when turned on or activated and this will also wake a sleeping repeater which will then proceed to wake those modules within its range. But some modules only wake specific single target modules such as the T24-HS handheld module and the T24-AO1 analog output module. For these modules to wake the repeater they must be fitted with at least v2.1 version radio modules. This only affects repeaters with a SleepDelay set.

Configuration

This section explains how to install software and connect the required devices together. Please note that you will need the T24 Toolkit software and a T24-BS base station to allow your computer to communicate with T24 telemetry devices.

Installation

T24 Toolkit

To configure the devices we must use the **T24 Toolkit** software application. This can be downloaded from our web site or may be shipped with your products.
Install this on a PC or laptop.
Run **setup.exe** and follow the prompts to install the software.

Base Station

If you have a USB version of the base station (T24-BSu) then you just need to plug this into a USB socket on your PC. If you are using an alternative base station then please refer to the appropriate manual.

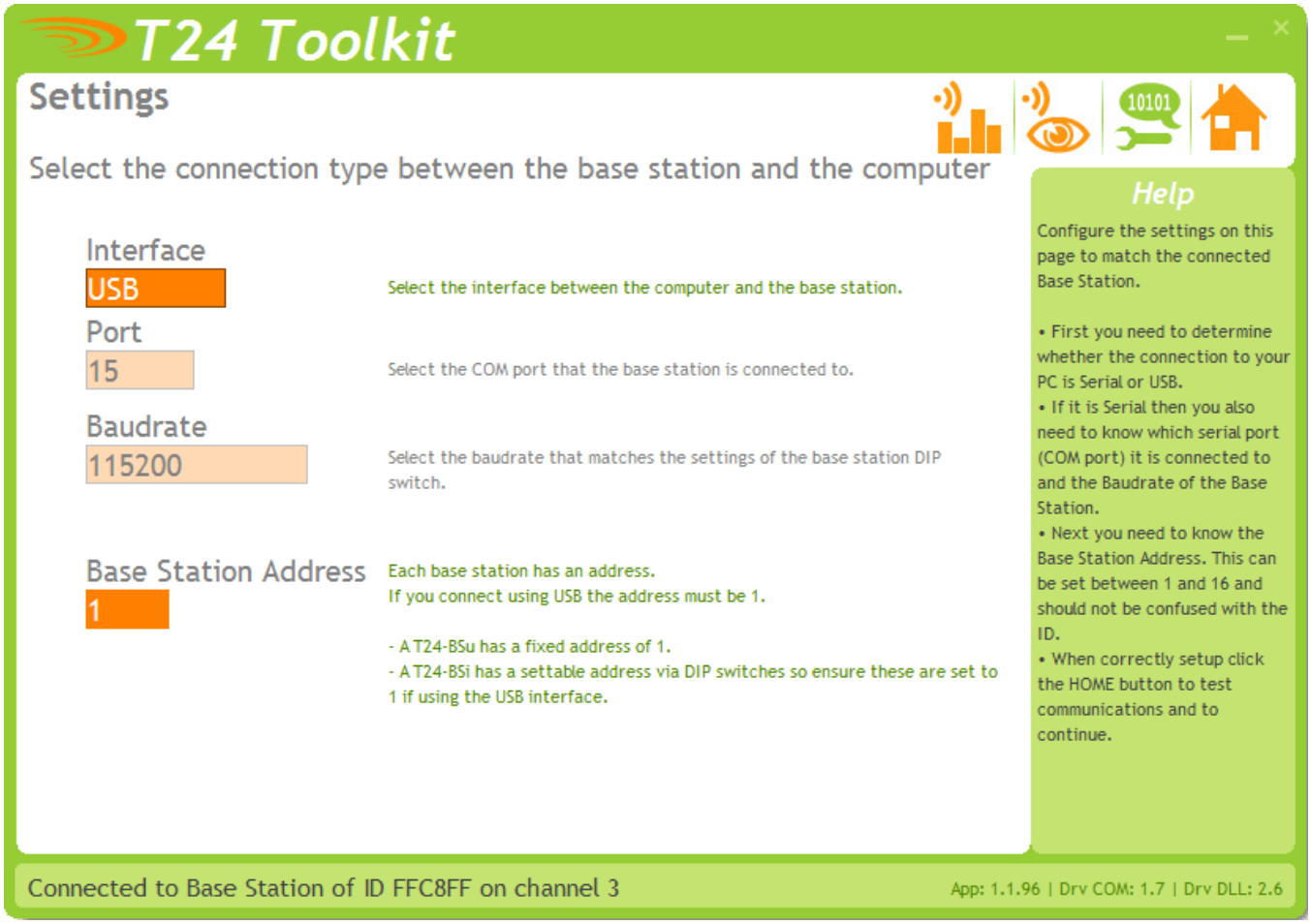
T24 Toolkit

The T24 Toolkit provides a means of simple configuration of the T24-AR along with useful tools to aid integration.

Run the T24 Toolkit software application.

General Pages

Setup Base Station Communications


T24 Toolkit
Settings
Select the connection type between the base station and the computer
Interface
USB
Select the interface between the computer and the base station.
Port
15
Select the COM port that the base station is connected to.
Baudrate
115200
Select the baudrate that matches the settings of the base station DIP switch.
Base Station Address
1
Each base station has an address.
If you connect using USB the address must be 1.
- A T24-BSu has a fixed address of 1.
- A T24-BSi has a settable address via DIP switches so ensure these are set to 1 if using the USB interface.
Help
Configure the settings on this page to match the connected Base Station.
• First you need to determine whether the connection to your PC is Serial or USB.
• If it is Serial then you also need to know which serial port (COM port) it is connected to and the Baudrate of the Base Station.
• Next you need to know the Base Station Address. This can be set between 1 and 16 and should not be confused with the ID.
• When correctly setup click the HOME button to test communications and to continue.
Connected to Base Station of ID FFC8FF on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

Select **USB** as the interface and select 1 as the Base Station Address.
In the toolkit all items that can be changed by the user are coloured orange.
To change a value just click on the relevant orange item. You will then be presented with a new dialog window allowing you to change the value.
This may use a slider, text box or list to allow your new value to be entered.

Click the Home button to attempt communications with the base station.
If no communications can be established the toolkit will remain on this page. You will need to check that the base station is powered and that it is connected to the converter correctly.

Home

T24 Toolkit
Home
Monitor or Log
You can view and log the data being transmitted from an acquisition module or view the spectrum analyser by clicking the icons above right. Pairing is NOT required to log data from your device.
Configure your device
To configure your module we need to temporarily pair to it. When we pair from the Toolkit we configure the base station radio settings to match the remote module.
To pair you must:
· Remove the power from your module.
· Initiate the pair by clicking the button below.
· Re-apply the power to the module.
When applying power be careful to do this cleanly because if the module is powered up with an intermittent connection it may reset during pairing and result in poor or no communications.
Pair
If the module cannot be paired because access to the power supply is either not possible or many modules share the same power supply. Click Here for advanced connection options.
Help
This Home page is where you begin your connection to your device.
You must be able to access its power supply so you can remove and reapply it.
The device you want to connect to must be the only device you reapply power to.
When pairing to a device the base station settings are changed to match those of the remote device.
[To connect to the base station hold the Shift key while clicking the Pair button]
Connected to Base Station of ID FFC8FF on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

We now have successful communications with the base station so we can now pair with our device or we can select the Spectrum Analyser mode or Data Provider Monitor mode.

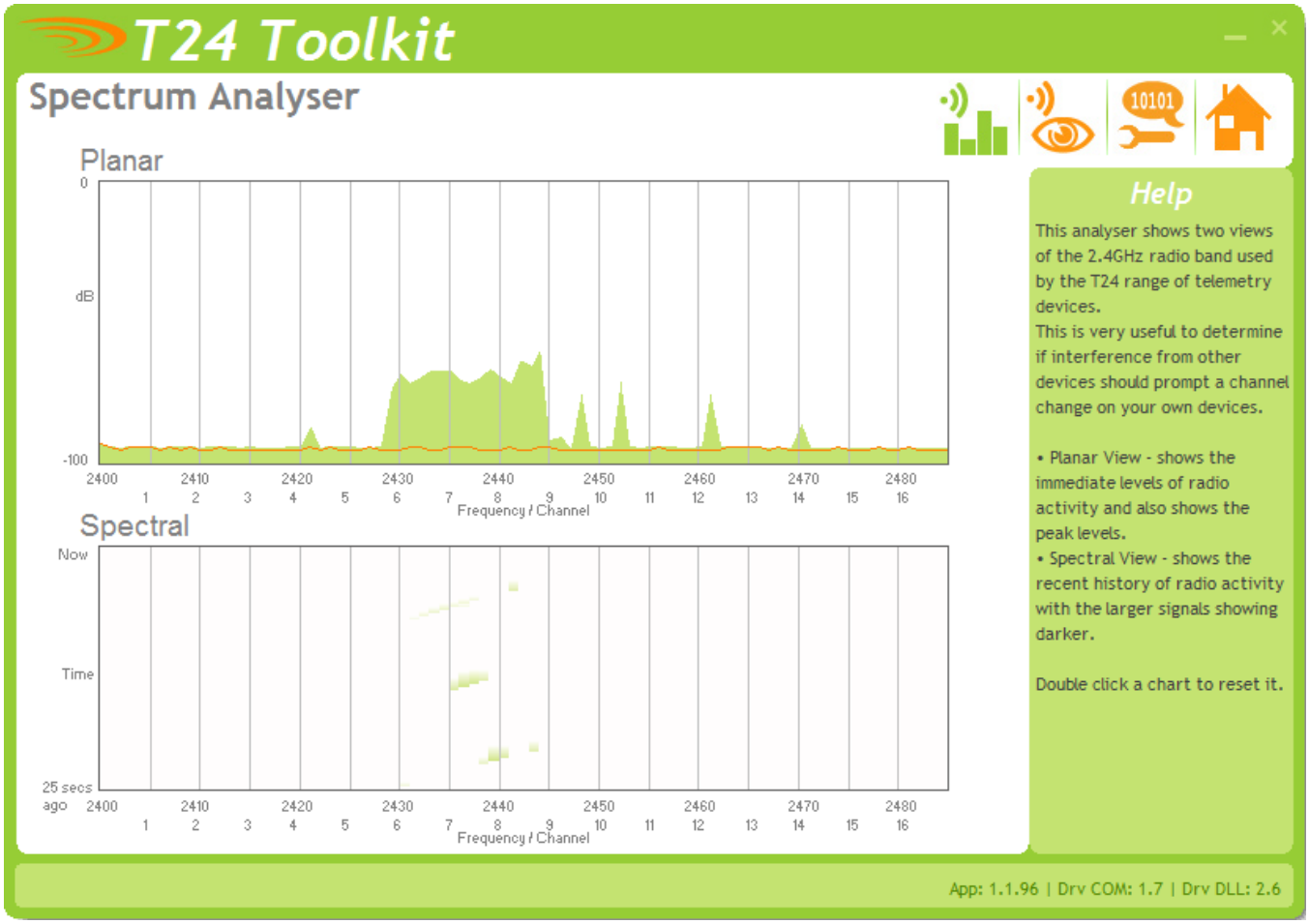
Pairing Procedure

- Remove power from the T24-AR module.
- Click the Pair button on the toolkit.
- You now have 10 seconds to re-apply power to the T24-AR module.

If you connect successfully the toolkit will change to the Information page.
If the pairing fails try again.

NOTE: The act of Pairing with the toolkit will **not** change the radio configuration settings of the connected device. The settings will only change if you change them yourself within the toolkit.

Analyser

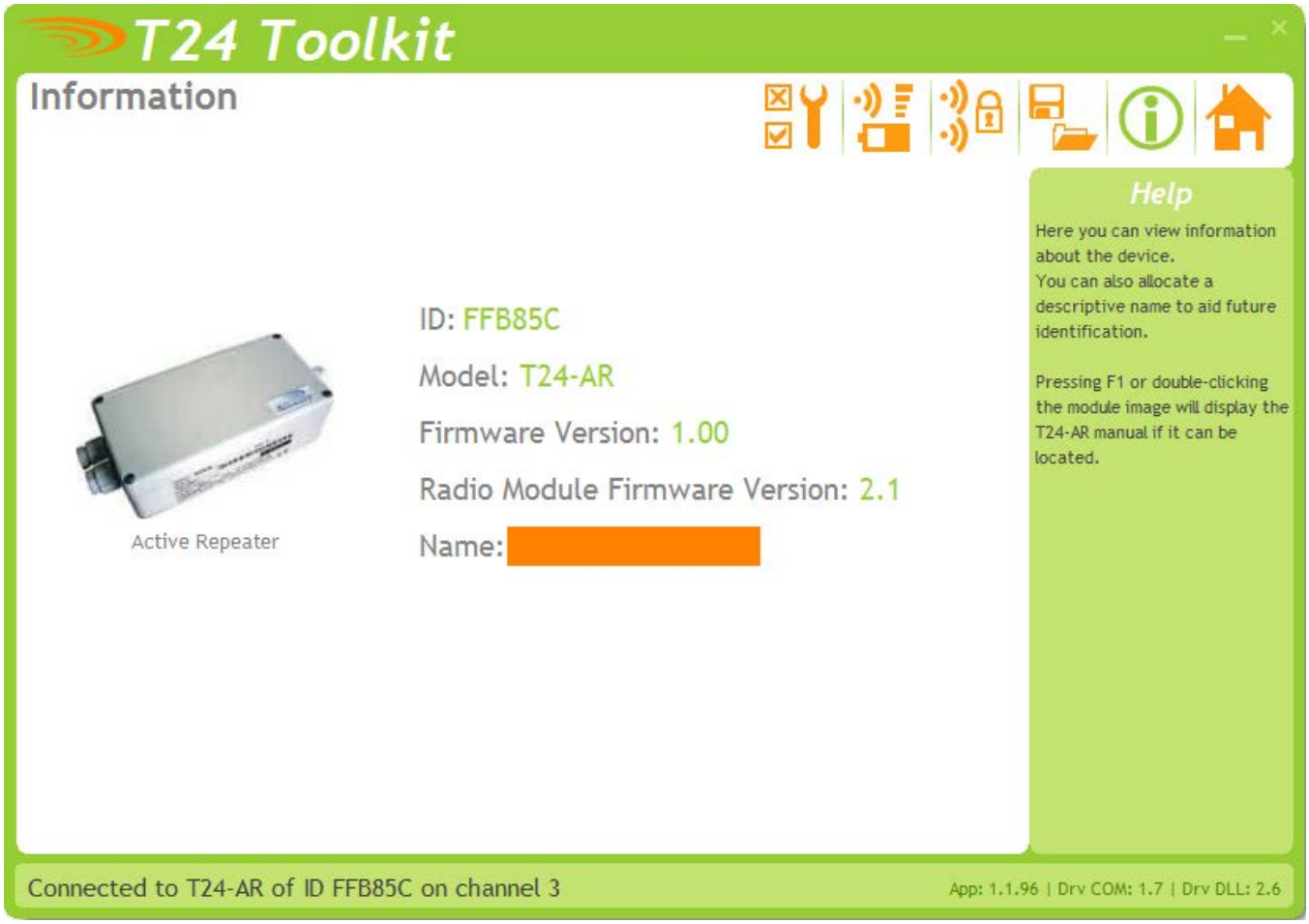

T24 Toolkit
Spectrum Analyser
Planar
0
dB
-100
2400 2410 2420 2430 2440 2450 2460 2470 2480
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Frequency / Channel
Spectral
Now
Time
25 secs ago
2400 2410 2420 2430 2440 2450 2460 2470 2480
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Frequency / Channel
Help
This analyser shows two views of the 2.4GHz radio band used by the T24 range of telemetry devices.
This is very useful to determine if interference from other devices should prompt a channel change on your own devices.
• Planar View - shows the immediate levels of radio activity and also shows the peak levels.
• Spectral View - shows the recent history of radio activity with the larger signals showing darker.
Double click a chart to reset it.
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

The analyser page is provided as a tool and will not normally be needed unless you plan to change channels and want to find the best channel to select, or to diagnose poor communications issues.

This page shows the radio signal levels detected across all the channels available to the T24 series of devices. Using this tool may help in detecting noisy areas and allow you to decide on which channels you may want to use.

The above charts show the traffic from a Wi-Fi network and it can be seen to be operating over channels 6 to 9 and it would be best (though not essential) to avoid using these channels.

Information

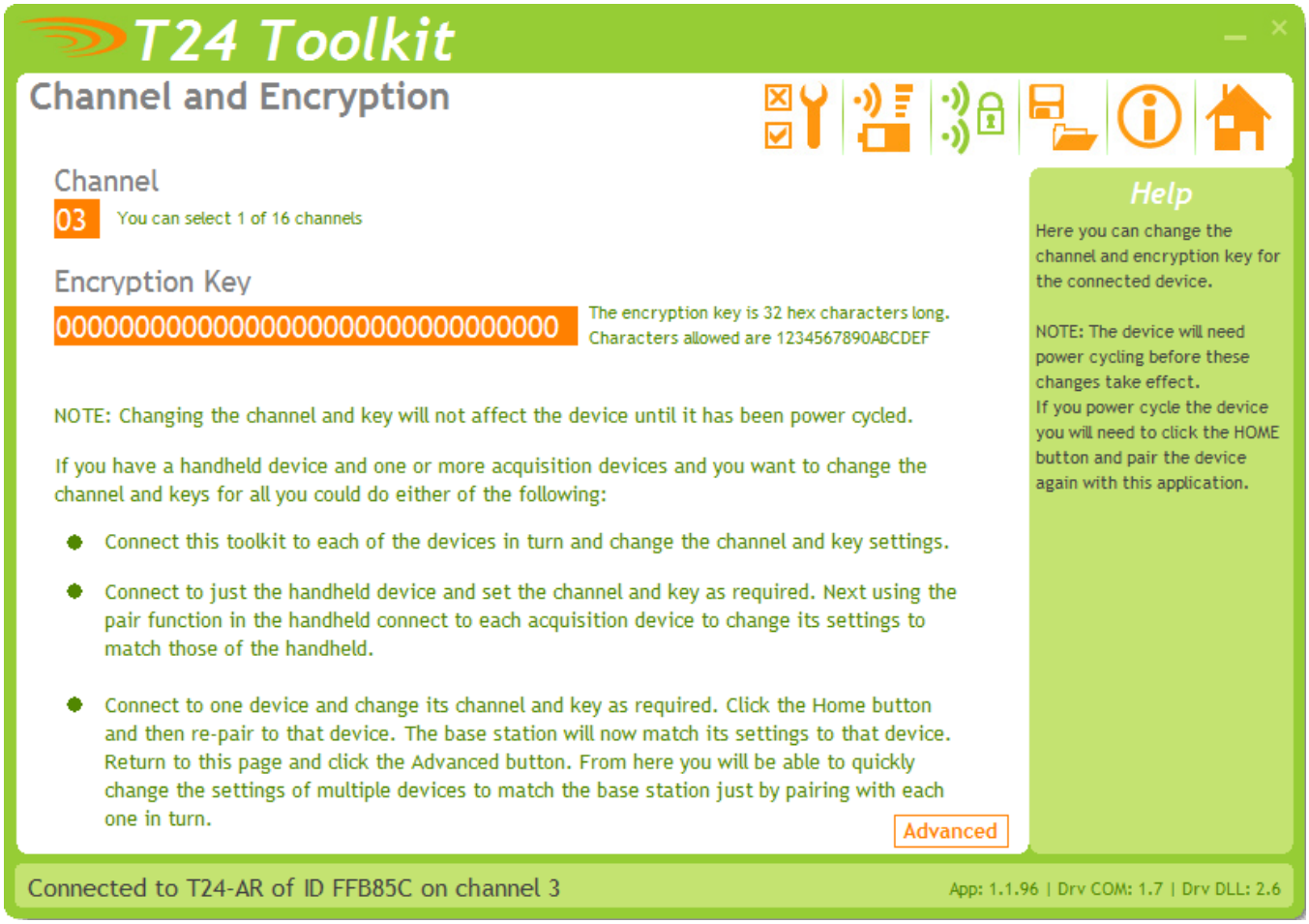

T24 Toolkit
Information
Help
Here you can view information about the device.
You can also allocate a descriptive name to aid future identification.
Pressing F1 or double-clicking the module image will display the T24-AR manual if it can be located.
Active Repeater
ID: FFB85C
Model: T24-AR
Firmware Version: 1.00
Radio Module Firmware Version: 2.1
Name:
Connected to T24-AR of ID FFB85C on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

This page shows you information about the connected device.

Items you can change:

Name	You can enter a short descriptive name (11 characters) which may help you recognise this device in the future.

Channel and Encryption


T24 Toolkit
Channel and Encryption
Channel
03
You can select 1 of 16 channels
Encryption Key
00000000000000000000000000000000
The encryption key is 32 hex characters long.
Characters allowed are 1234567890ABCDEF
NOTE: Changing the channel and key will not affect the device until it has been power cycled.
If you have a handheld device and one or more acquisition devices and you want to change the channel and keys for all you could do either of the following:
Connect this toolkit to each of the devices in turn and change the channel and key settings.
Connect to just the handheld device and set the channel and key as required. Next using the pair function in the handheld connect to each acquisition device to change its settings to match those of the handheld.
Connect to one device and change its channel and key as required. Click the Home button and then re-pair to that device. The base station will now match its settings to that device. Return to this page and click the Advanced button. From here you will be able to quickly change the settings of multiple devices to match the base station just by pairing with each one in turn.
Advanced
Help
Here you can change the channel and encryption key for the connected device.
NOTE: The device will need power cycling before these changes take effect.
If you power cycle the device you will need to click the HOME button and pair the device again with this application.
Connected to T24-AR of ID FFB85C on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

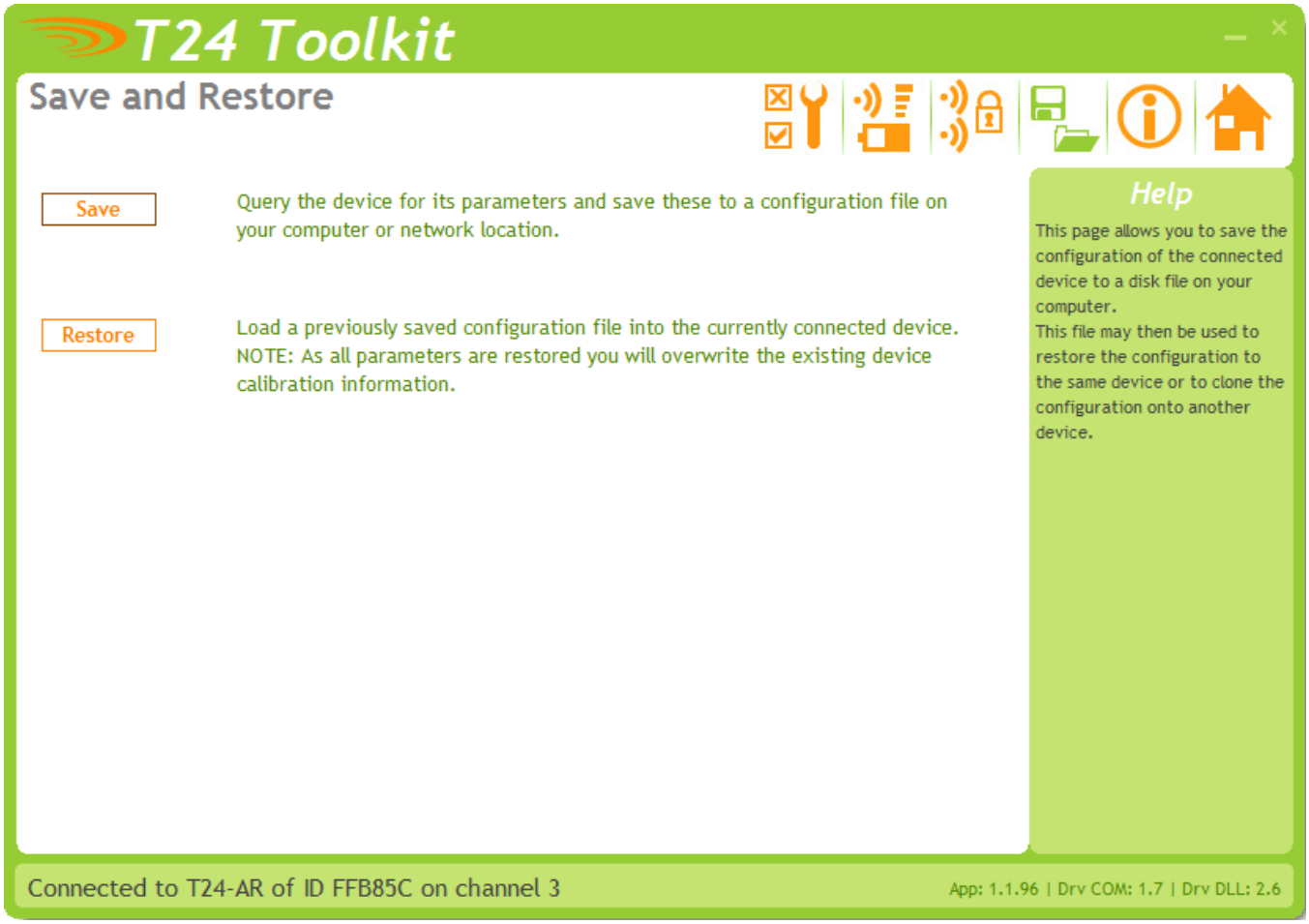
Here you can change the channel and encryption key for the module.

NOTE: Early acquisition module do not yet utilise the encryption keys so these should be left at all zeros.

Items you can change:

Channel	Select a channel between 1 and 16. The default is channel 1. You can use the Spectrum Analyser mode to determine a good clean channel to use. NOTE: Channel 16 is used to negotiate pairing so avoid this channel if possible.
Encryption Key	Only devices with identical encryption keys can communicate. You can isolate groups of devices on the same channel or just use the key to ensure the data cannot be read by somebody else.

Save and Restore

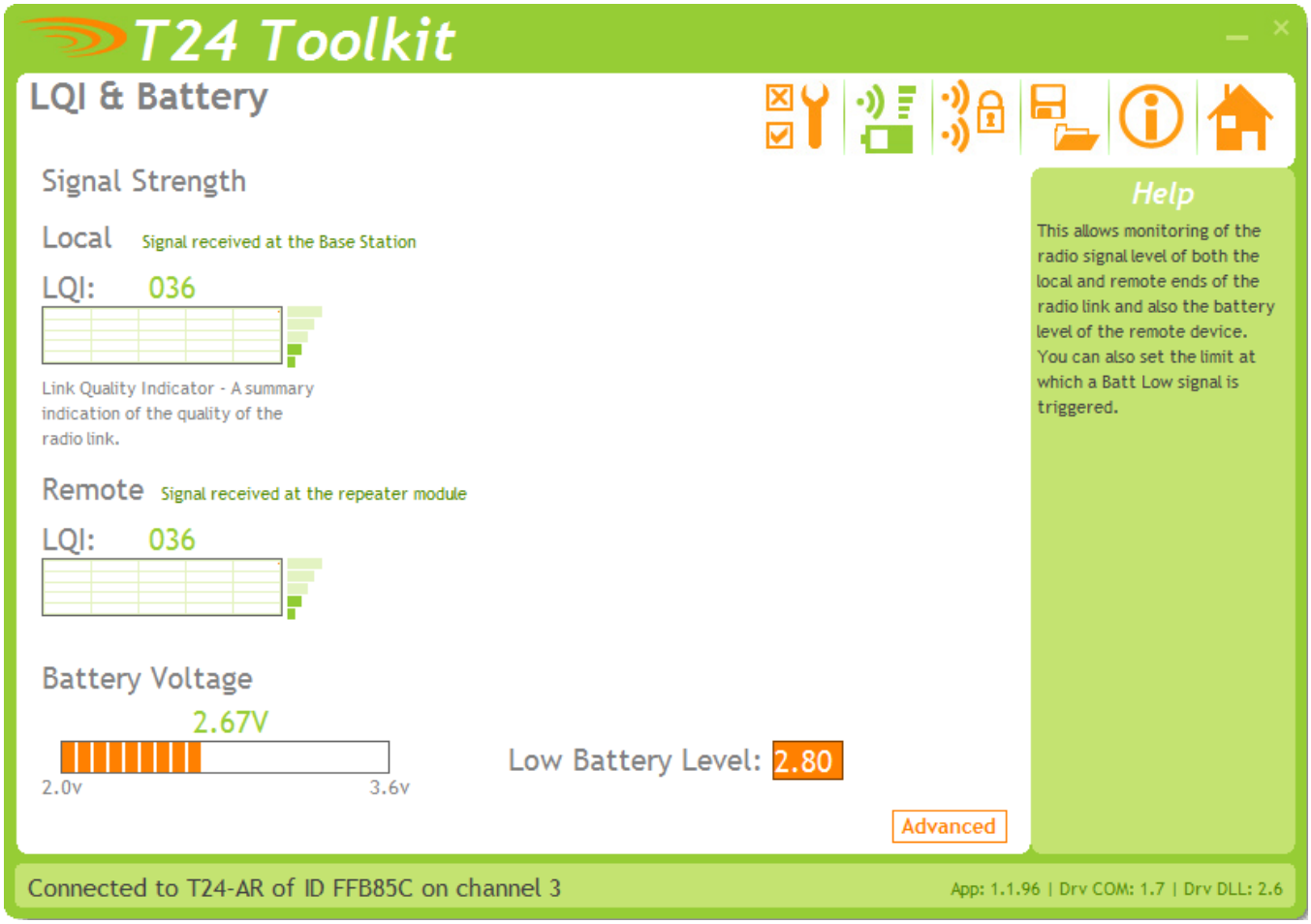

T24 Toolkit
Save and Restore
Save
Query the device for its parameters and save these to a configuration file on your computer or network location.
Restore
Load a previously saved configuration file into the currently connected device.
NOTE: As all parameters are restored you will overwrite the existing device calibration information.
Help
This page allows you to save the configuration of the connected device to a disk file on your computer.
This file may then be used to restore the configuration to the same device or to clone the configuration onto another device.
Connected to T24-AR of ID FFB85C on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

Here you can save the device settings to a file on your PC so that they can be later loaded back into the same or different device.

Items you can change:

Save	Click this button to open a file dialog window to allow you to select a filename and location to save the configuration file to. All configuration information including calibration data will be saved to the file. The file extension is tcf.
Restore	Click this button to open a file dialog window to allow you to select a filename and location of a previously saved file to load into the connected device. All configuration information **including** calibration data will be overwritten. The file extension is tcf.
Advanced Settings	Click this button to enter the Advanced Settings Page. Here are settings which do not normally require changing.

Battery and Radio Levels


T24 Toolkit
LQI & Battery
Signal Strength
Local
Signal received at the Base Station
LQI: 036
Link Quality Indicator - A summary indication of the quality of the radio link.
Remote
Signal received at the repeater module
LQI: 036
Battery Voltage
2.67V
2.0v
3.6v
Low Battery Level: 2.80
Advanced
Help
This allows monitoring of the radio signal level of both the local and remote ends of the radio link and also the battery level of the remote device. You can also set the limit at which a Batt Low signal is triggered.
Connected to T24-AR of ID FFB85C on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

Here you can see the voltage of the battery and the radio signal levels at the base station and the remote acquisition module. This simple view gives an LQI value which stands for Link Quality Indicator. This value will range from 0 to 100 and within this band you should still achieve communications. As the level drops towards zero communications may become intermittent but still achievable.

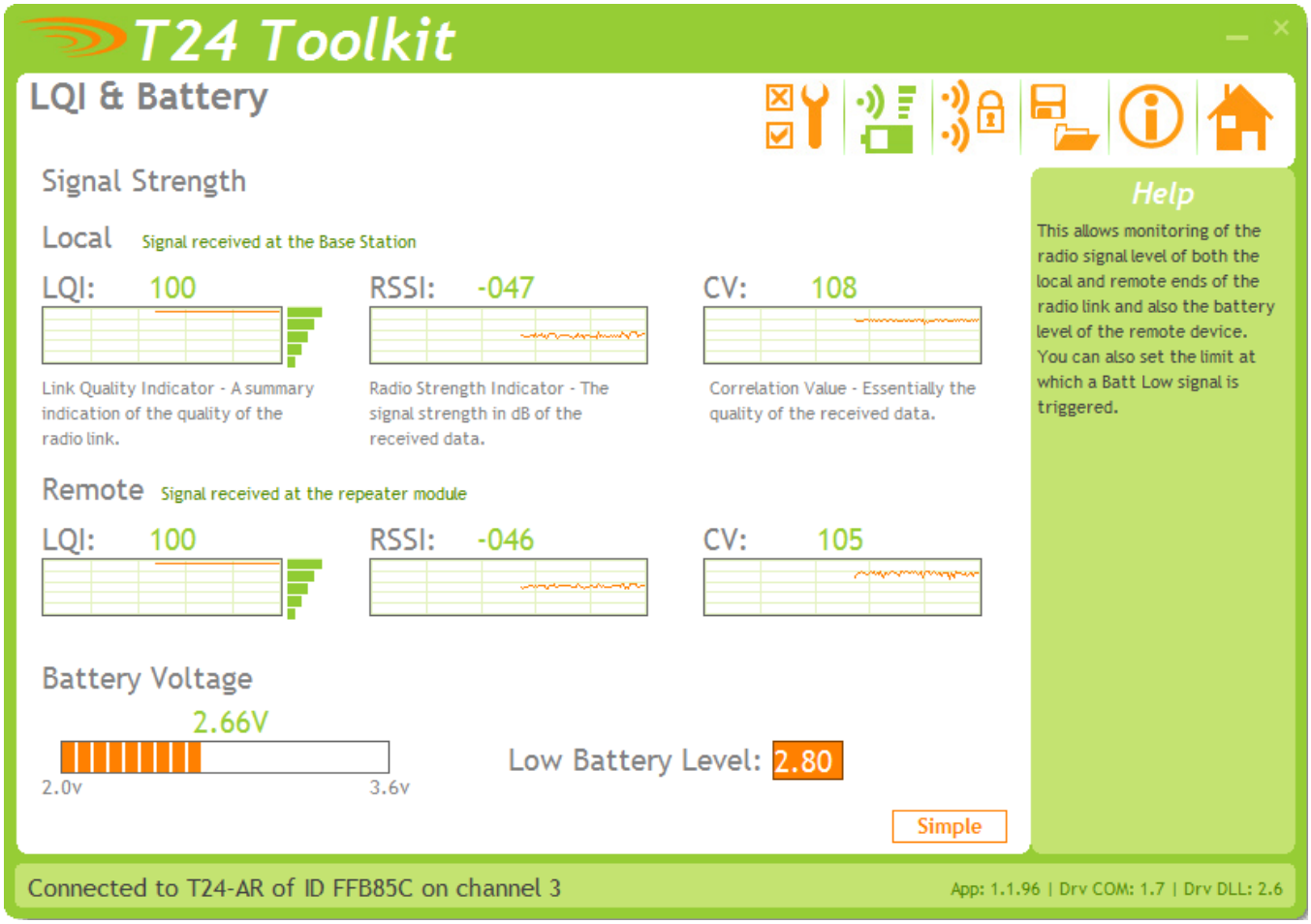
You can set the level at which the acquisition module reports a low battery.
If the battery voltage is below the Low Battery Level the bar will be coloured orange.

Items you can change:

Low Battery Level	Click this item to set the battery low level.

Clicking the Advanced button will give more detailed information on the RSSI and CV levels of the received radio packets.

Battery and Radio Levels Advanced Settings


T24 Toolkit
LQI & Battery
Signal Strength
Local
Signal received at the Base Station
LQI: 100
RSSI: -047
CV: 108
Link Quality Indicator - A summary indication of the quality of the radio link.
Radio Strength Indicator - The signal strength in dB of the received data.
Correlation Value - Essentially the quality of the received data.
Remote
Signal received at the repeater module
LQI: 100
RSSI: -046
CV: 105
Battery Voltage
2.66V
2.0v
3.6v
Low Battery Level: 2.80
Simple
Help
This allows monitoring of the radio signal level of both the local and remote ends of the radio link and also the battery level of the remote device. You can also set the limit at which a Batt Low signal is triggered.
Connected to T24-AR of ID FFB85C on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

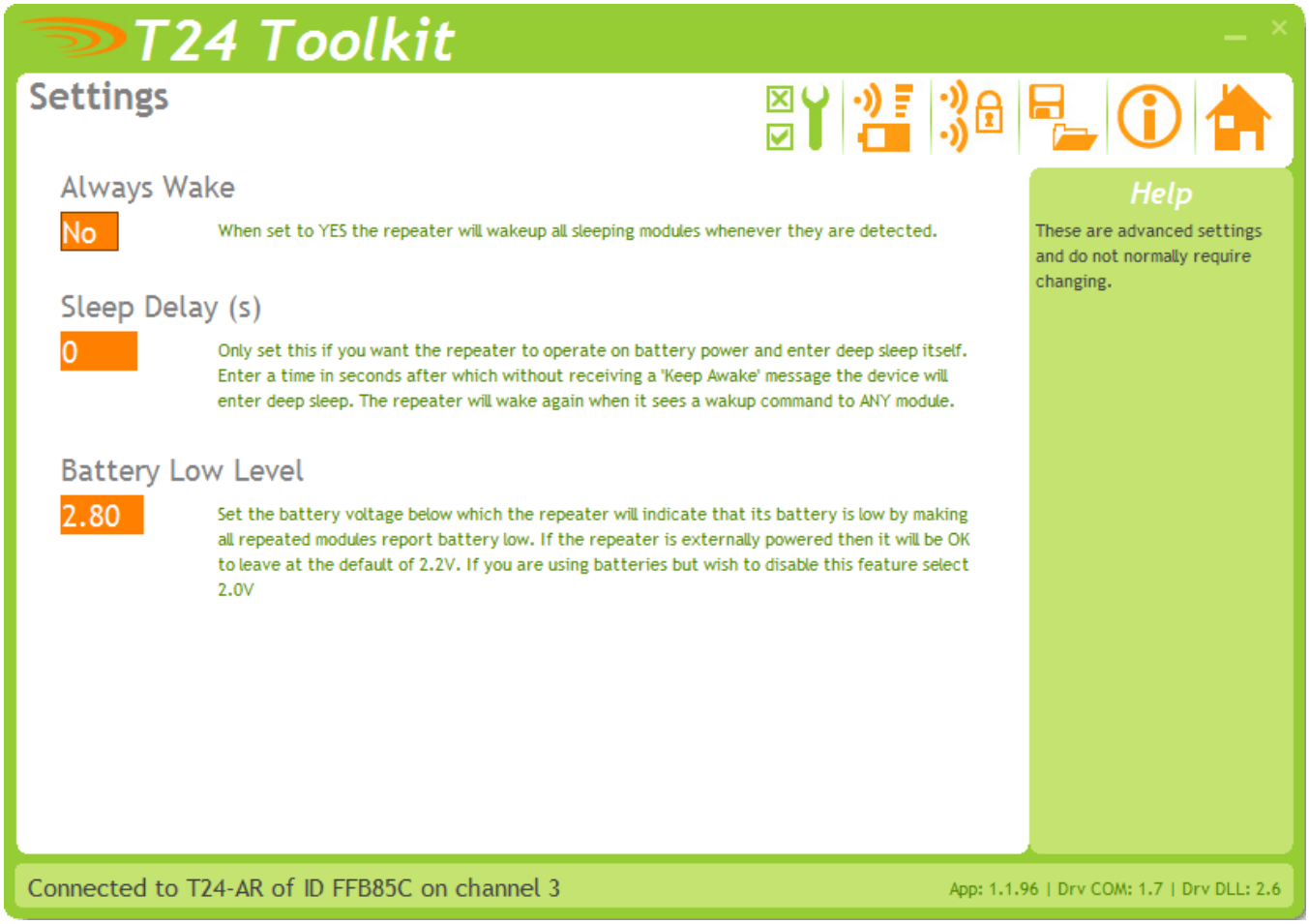
LQI value which stands for Link Quality Indicator. This value will range from 0 to 100 and within this band you should still achieve communications. As the level drops towards zero communications may become intermittent but still achievable.

RSSI is effectively the received dB level which will range from about -30 which is a good signal to -90 which is a weak signal.

CV is the correlation value and indicates how well the signal can be decoded. This ranges from 55 which is a poor quality signal and 110 which is an excellent signal.

This page could be used when performing a site survey to determine the signal levels at both the repeater and other T24 modules. Just use the toolkit on a laptop to enable the signal to be tested at different locations.

Settings


T24 Toolkit
Settings
Always Wake
No
When set to YES the repeater will wakeup all sleeping modules whenever they are detected.
Sleep Delay (s)
0
Only set this if you want the repeater to operate on battery power and enter deep sleep itself. Enter a time in seconds after which without receiving a 'Keep Awake' message the device will enter deep sleep. The repeater will wake again when it sees a wakup command to ANY module.
Battery Low Level
2.80
Set the battery voltage below which the repeater will indicate that its battery is low by making all repeated modules report battery low. If the repeater is externally powered then it will be OK to leave at the default of 2.2V. If you are using batteries but wish to disable this feature select 2.0V
Help
These are advanced settings and do not normally require changing.
Connected to T24-AR of ID FFB85C on channel 3
App: 1.1.96 | Drv COM: 1.7 | Drv DLL: 2.6

Here you can change the settings for the repeater.

Items you can change:

Always Wake	In some cases where the repeater is manually powered on and off you may want it to wake all sleeping modules within its range. Set this option to Yes to enable this. The modules you wake should have their own Sleep Delay settings set so they go back to sleep after stopping receiving Stay Awake messages from the data consumer (PC or handheld).
Sleep Delay	If the repeater is to be battery powered and you want to operate in low power mode you can employ this delay. Once the repeater stops hearing Stay Awake messages from the data consumer (PC or handheld etc) it will go to sleep after this amount of time. The repeater will wake when any other module is woken.
Battery Low Level	Select the battery voltage below which the repeater will report a low battery. It does this by making all repeated devices report a low battery so the data consumer (a handheld or PC software etc) will be able to detect a problem. The battery level applies to the voltage seen after 3V regulation. The default is 2.2V and can be left at this when the repeater is powered externally. If the repeater is battery powered and you wish to disable this feature select 2.0V

Specifications

General Radio

	Min	Typical	Max	Units
License		License Exempt		
Modulation method		MS (QPSK)		
Radio type		Transceiver (2 way)		
Data rate		250		K bits/sec
Radio Frequency	2.4000		2.4835	GHz
Power		1		mw
Range RAD24e (External antenna)			200 (650)	Metres (feet) *
Channels (DSSS)		16		

***** Maximum range achieved in open field site at a height of 3 metres above ground.

T24-AR

Parameter	Minimum	Typical	Maximum	Units
Battery Supply Voltage	2.1	3	3.6	V DC
External DC Supply	5		18	V DC
Operating Temperature Range	-40	-	85**	°C
Storage Temperature Range	-40	-	85	°C
Reverse polarity Protection		-	-32	V DC
Environmental protection with suitable cables exiting through cable glands.		IP65		
Battery life using Duracell LR20 'D' cells with the T24-AR permanently activated. **		285 12		Hours Days

**Batteries used may have reduced operating temperature range.
Usually using batteries the T24-AR would be utilising the SleepDelay to return to sleep. Therefore the actual daily usage would allow for far greater than the stated battery life. For example: If the T24-AR was used for 1 hour per day then the battery life would be 6840 hours or 288 days or nearly 10 months.

The specifications for the actual fitted acquisition module are listed in the acquisition module manual.

Approvals

CE

CE

Complies with EMC directive. 2004/108/EC
The Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive, 1999/5/EC,

European Community, Switzerland, Norway, Iceland, and Liechtenstein

English:	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Deutsch:	Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprecheneden Vorgaben der Richtlinie 1999/5/EU.
Dansk:	Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Directiv 1999/5/EF.
Español:	Este equipo cumple con los requisitos esenciales asi como con otras disposiciones de la Directive 1999/5/EC.
Français:	Cet appareil est conforme aux exigencies essentialles et aux autres dispositions pertinantes de la Directive 1999/5/EC.
Íslenska:	Þessi búnaður samrýmist lögboðnum kröfum og öðrum ákvæðum tilskipunar 1999/5/ESB.
Italiano:	Questo apparato é conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 1999/5/EC.
Nederlands:	Deze apparatuur voldoet aan de belangrijkste eisen en andere voorzieningen van richtlijn 1999/5/EC.
Norsk:	Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-directiv 1999/5/EC.
Português:	Este equipamento satisfaz os requisitos essenciais e outras provisões da Directiva 1999/5/EC.
Suomalainen:	Tämä laite täyttää direktiivin 1999/5/EY oleelliset vaatimukset ja on siinä asetettujen muidenkin ehtojen mukainen.
Svenska:	Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 1999/5/EC.

This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

FCC

FC

Family: RAD24
Models: i and e for internal and external antenna variants. For antenna T24-ANTA and T24-ANTB
FCC ID:VHARAD24
This device complies with Part 15c of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAUTION: If the device is changed or modified without permission from Mantracourt Electronics Ltd, the user may void his or her authority to operate the equipment.

Industry Canada

Industry Canada Industrie Canada

Models: i and e for internal and external antenna variants. For antenna T24-ANTA and T24-ANTB
IC:7224A-RAD24
This apparatus complies with RSS-210 - Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS.

OEM / Reseller Marking and Documentation Requirements

FCC

The Original Equipment Manufacturer (OEM) must ensure that FCC labelling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents as shown:

> Contains FCC ID:VHARAD24
>
> This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
>
> (1) this device may not cause harmful interference and
>
> (2) this device must accept any interference received, including interference that may cause undesired operation.

The acquisition modules have been tested with T24-ANTA and T24-ANTB. When integrated in OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas other than T24-ANTA and T24-ANTB must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

Acquisition modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by Mantracourt could void the user's authority to operate the equipment.

In order to fulfil the certification requirements, the OEM must comply with FCC regulations:
1. The system integrator must ensure that the text on the external label provided with this device is placed on the outside of the final product.
2. The acquisition modules with external antennas may be used only with Approved Antennas that have been tested by mantracourt.

IC

Labelling requirements for Industry Canada are similar to those of the FCC. A clearly visible label on the outside of the final product enclosure must display the following text:

> Contains Model RAD24 Radio (2.4 GHz), IC:7224A-RAD24

Integrator is responsible for its product to comply with RSS-210 - Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS.

CE

The T24 series has been certified for several European countries.
If the acquisition module is incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low-voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive. Furthermore, the manufacturer must maintain a copy of the T24 device user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

OEM Labelling Requirements

The 'CE' marking must be affixed to a visible location on the OEM product.

The CE mark shall consist of the initials “CE” taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be respected.
- The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

Declaration of Conformity

We, **Mantracourt Electronics Limited**
The Drive
Farringdon
Exeter
Devon EX5 2JB
declare under our sole responsibility that our products in the **T24 Radio Telemetry Product Range** to which this declaration relates are in conformity with the appropriate standard EN 300 328 following the provisions of the Radio and Telecommunications Terminal Equipment Directive **1999/5/EC**, **FCC CFR Title 47** part 15c BS EN 61000-4-2 and BS EN 61000-4-3 following the provisions of the EMC Directive **2004/108/EC** and Low Voltage Directive **2006/95/EC**.

December 2007

Brett James
Development Manager
Mantracourt Electronics Limited.

FCC ID:VHARAD24

CE

Worldwide Regional Approvals

Region	Product Conforms To
Europe	CE
USA	FCC
Canada	IC
Australia	To Be Determined
China	To Be Determined
Japan	To Be Determined

Important Note

Mantracourt does not list the entire set of standards that must be met for each country. Mantracourt customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market. For more information relating to European compliance of an OEM product incorporating the T24 range of modules, contact Mantracourt, or refer to the following web site: **www.ero.dk**

Warranty

All Telemetry products from Mantracourt Electronics Ltd., ('Mantracourt') are warranted against defective material and workmanship for a period of (1) one year from the date of dispatch.

If the 'Mantracourt' product you purchase appears to have a defect in material or workmanship or fails during normal use within the period, please contact your Distributor, who will assist you in resolving the problem. If it is necessary to return the product to 'Mantracourt' please include a note stating name, company, address, phone number and a detailed description of the problem. Also, please indicate if it is a warranty repair.

The sender is responsible for shipping charges, freight insurance and proper packaging to prevent breakage in transit.

'Mantracourt' warranty does not apply to defects resulting from action of the buyer such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorised modification.

No other warranties are expressed or implied. 'Mantracourt' specifically disclaims any implied warranties of merchantability or fitness for a specific purpose. The remedies outlined above are the buyer's only remedies. 'Mantracourt' will not be liable for direct, indirect, special, incidental or consequential damages whether based on the contract, tort or other legal theory.

Any corrective maintenance required after the warranty period should be performed by 'Mantracourt' approved personnel only.

Industry Canada
Industrie Canada

Designed, manufactured and supported in the UK

ISO 9001
REGISTERED FIRM

In the interests of continued product development, Mantracourt Electronics Limited reserves the right to alter product specifications without prior notice.

Code No. 517-925	Issue 1.3	11.04.14

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